

# Center of Excellence

## For Airport Technology



April 11, 2003  
FAA William J. Hughes Technical Center  
Atlantic City International Airport, NJ

**David Brill, Ph.D.**  
**Airport Technology Program Manager**

# Members



- 
- **University of Illinois at Urbana-Champaign, *Urbana, IL* (Lead/Prime)**
  - **Northwestern University, *Evanston, IL***
  - **Embry-Riddle Aeronautical University, *Prescott, AZ***
  - **North Carolina A&T University, *Greensboro, NC***

# FAA Advisory Committee

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- **Dr. Satish K. Agrawal, Manager, Airport Technology R&D Branch (AAR-410)**
- **Dr. Gordon F. Hayhoe, Manager, National Airport Pavement Test Facility**
- **Dr. David R. Brill, FAA COE Program Manager/Technical Monitor**
- **Dr. Patricia Watts, FAA Center of Excellence Program Director**

# COE Faculty Members

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- **Director: Dr. Barry Dempsey, UIUC**
- **Research Faculty (P.I.'s):**
  - **Pavements area (8):**  
**M. Thompson; E. Barenberg; S. Carpenter; J. Roesler; W. Buttlar; E. Tutumluer; D. Lange (UIUC); S. Shah (Northwestern)**
  - **Wildlife Safety area (7):**  
**E. Herricks (UIUC); A. Dickey (ERAU); D. Schaeffer, P. Mankin, R. Larkin, R. Warner, P. Chen (UIUC)**

# Student Involvement



- 
- **Currently 7 Ph.D. students assigned to COE research projects.**
  - **22 Ph.D. dissertations completed to date.**
  - **Other student researchers:**
    - **Undergraduate: 0**
    - **Masters: 5**
    - **Post-Doc: 1**
  - **6 - 7 graduate student interns will be involved in HBCU summer program.**

# History & Background

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- **Established in 1995 as the FAA Center of Excellence for Airport Pavement Research.**
  - **Oldest of current 4 Centers of Excellence.**
  - **Name change effected in 2001 to reflect the addition of Airport Safety (WHAS) research.**
- **Two Phases:**
  - **Phase 1 (through 1999) concentrated on basic research activities.**
  - **Phase 2 (1999 - present) emphasizes research in support of NAPTF activities.**

# Research Facilities

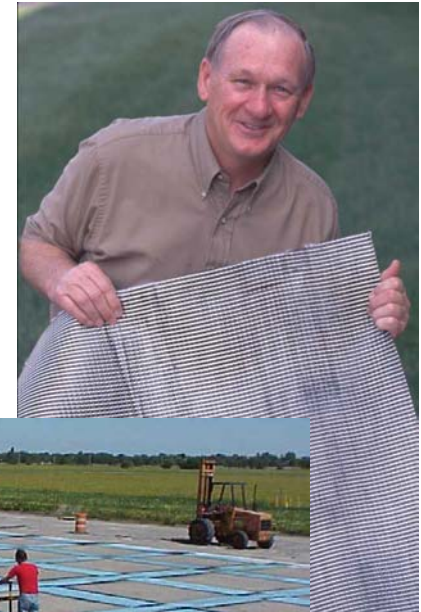


- **ATREL (Advanced Transportation R&E Laboratory)**
  - **Laboratory Facilities**
  - **Former Chanute AFB**
  - **Advanced Transportation Loading System (ATLaS)**
- **Center for Advanced Cement-Based Materials (Northwestern)**





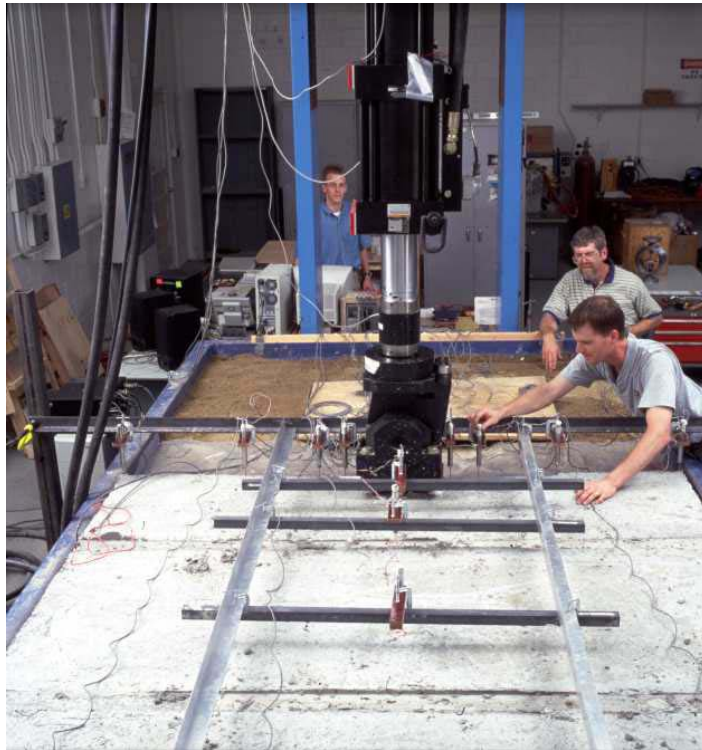
# Facilities





# COE Research Activities

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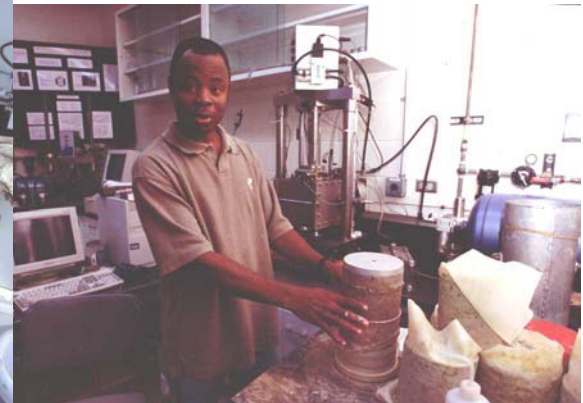
# COE Research Activities



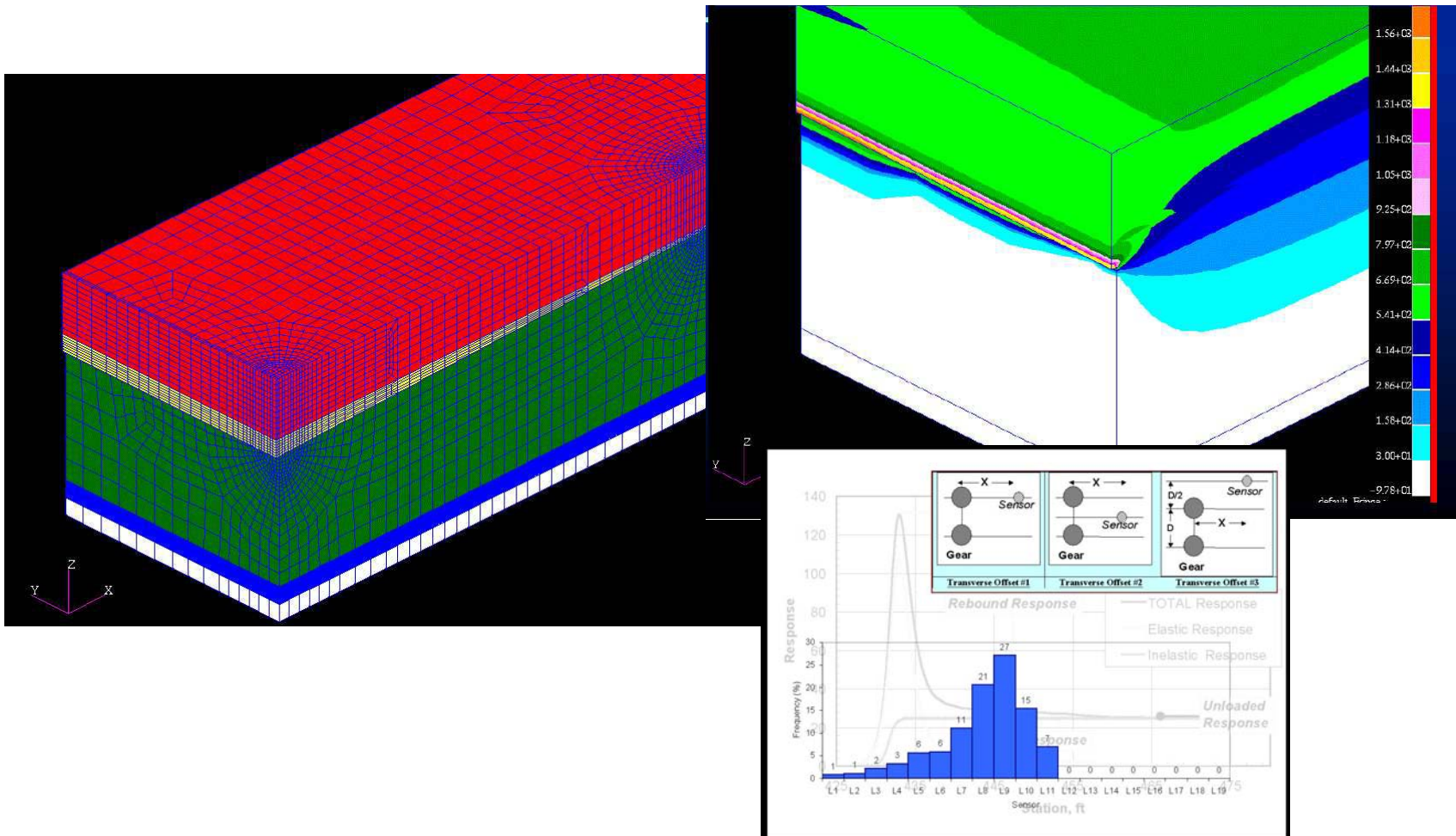


# COE Research Activities

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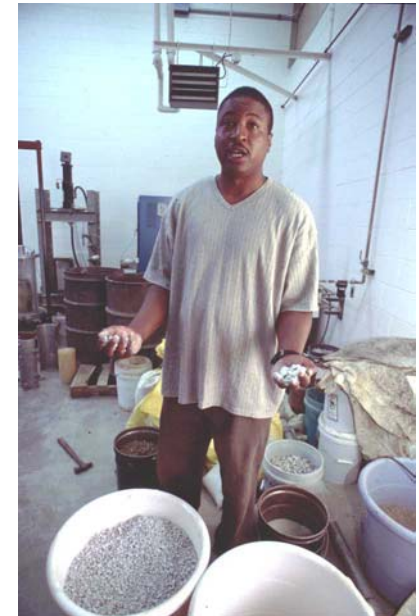
# COE Research Activities





# COE Outreach Activities

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# Funding Background



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- **All FAA funding in the form of 1-for-1 matched grants.**
  - **Awards to Airport Technology COE:**
    - **FAA Funding: \$5M**
    - **Matching Funding: \$5M**
  - **Matching funds primarily in the form of university contributions.**

# Other Participants

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- **Limited support from industry**
  - **Boeing Company**
  - **Trigon Engineering Consultants, Inc.**  
(participation in HBCU outreach program)
  - **Crawford, Murphy & Tilly, Inc.,**  
**Rantoul, IL**



# **Publications To Date**



- 
- **22 Ph.D. Dissertations**
  - **19 COE Technical Reports**
  - **182 technical publications including:**
    - **Papers in Conference Proceedings**
    - **Refereed Journal Papers**
    - **Department Publications**
    - **Papers delivered at FAA Airport Technology Transfer Conferences**

# What We Bring To the Table

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## → **FAA:**

- **Funding source**
- **Unique full-scale test data from National Airport Pavement Test Facility (NAPTF)**

## → **COE:**

- **100% matching funds**
- **Recognized expertise in a variety of areas**
- **Access to experimental facilities**
- **Next generation of airport researchers**

# Technology Areas



- 
- **Airport Pavement Technology**
    - **Data Analysis from Full-Scale Testing**
    - **Structural Modeling**
    - **Advanced Materials Studies**
    - **Concrete Pavement Fatigue**
  - **Wildlife Hazard Mitigation Technology**
    - **Wildlife Hazard Abatement Systems (WHAS)**
    - **Wildlife Hazard Information Prototype**

# Selected Completed Projects - Phase I

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- *Anisotropic Modeling of Granular Bases* (E. Tutumluer, UIUC)
- *Wheel Load Interaction: Critical Airport Pavement Responses* (M. Thompson, UIUC)
- *Joint Performance of Concrete Joints Subject to Cyclic Shear* (E. Barenberg, UIUC)
- *Fatigue of Concrete Subject to Biaxial Load in the Tension Region* (S. Shah, Northwestern)

# Completed Projects - Phase 2

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- *Analyze Pavement Responses at Denver Intl Airport* (E. Barenberg, J. Roesler, UIUC)
- *3D Finite Element Software Improvements* (D. Parsons, UIUC)
- *Recycled Materials in Aviation Pavements* (S. Carpenter, UIUC)
- *Coal-Tar Sealer-Rejuvenator Specification* (S. Carpenter, UIUC)
- *Analyze NAPTf Pavement Response Data* (M. Thompson/E. Barenberg, UIUC)

# Current Projects - Outreach

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## → **Minority Summer Internship Program**

- **Supports 5-7 HBCU students at UIUC for 12 week internship.**
- **The goal is to increase the number of under-represented minorities obtaining advanced degrees in civil engineering.**
- **Success rate: 3 former interns from 2001 and 2002 have gone on to enroll in graduate studies at UIUC (2 Ph.D. & 1 M.S.).**



# Current Projects - Pavement

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## → Rigid (Concrete) Pavement Research:

→ *Fatigue Resistance of  
Airport Concrete Pavements*  
(P.I.: J. Roesler, UIUC)

→ *Fatigue Behavior of Concrete  
Airport Pavement in 3D Space*  
(P.I.: S. Shah, Northwestern)

→ *Moisture Curling of Concrete Slabs in Airfield  
Applications* (P.I.'s: D. Lange & J. Roesler, UIUC)





# Current Projects - Pavement

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## → Flexible (Asphalt) Pavement Research:

→ *Analysis of NAPTF Flexible Pavement Dynamic Data*  
(P.I.: M. Thompson, UIUC)

→ *NAPTF Materials Testing*  
(P.I.: E. Tutumluer, UIUC)

→ *Fatigue in Airport Asphalt Concrete Pavements* (P.I.: S. Carpenter, UIUC)

→ *Evaluate Flexible Overlay Design Methods for Airport Pavements* (P.I.: W. Buttlar, UIUC)



# Pavement Outputs



- 
- **Rigid Pavement Research Projects:**
    - **Improved estimate of concrete slab fatigue cycles for triple-dual-tandem (TDT) aircraft (2003)**
    - **Model of concrete fatigue response under complex 3D aircraft loading (2004)**
    - **Guidelines for minimizing distresses caused by slab curling and warping (2006)**

# Pavement Outputs



- 
- **Flexible Pavement Research Projects:**
    - **Analysis/modeling of NAPTF test data:**
      - Multiple wheel interaction effects
      - Rut depth analysis
    - **Recommendations for improving current FAA asphalt overlay design procedures (2004)**
    - **New laboratory test method to characterize rutting potential of unbound layers (2005)**

# Current Projects - Wildlife

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## → *Wildlife Hazard Abatement Systems (WHAS)*

**P.I.: Dr. Edwin Herricks, UIUC**

**co-P.I.: Dr. Archie Dickie, ERAU Prescott**

### → **UIUC Wildlife Strike Mitigation Team:**

**Dr. Dave Schaeffer (Risk Assessment)**

**Dr. Phillip Mankin (Field Operations)**

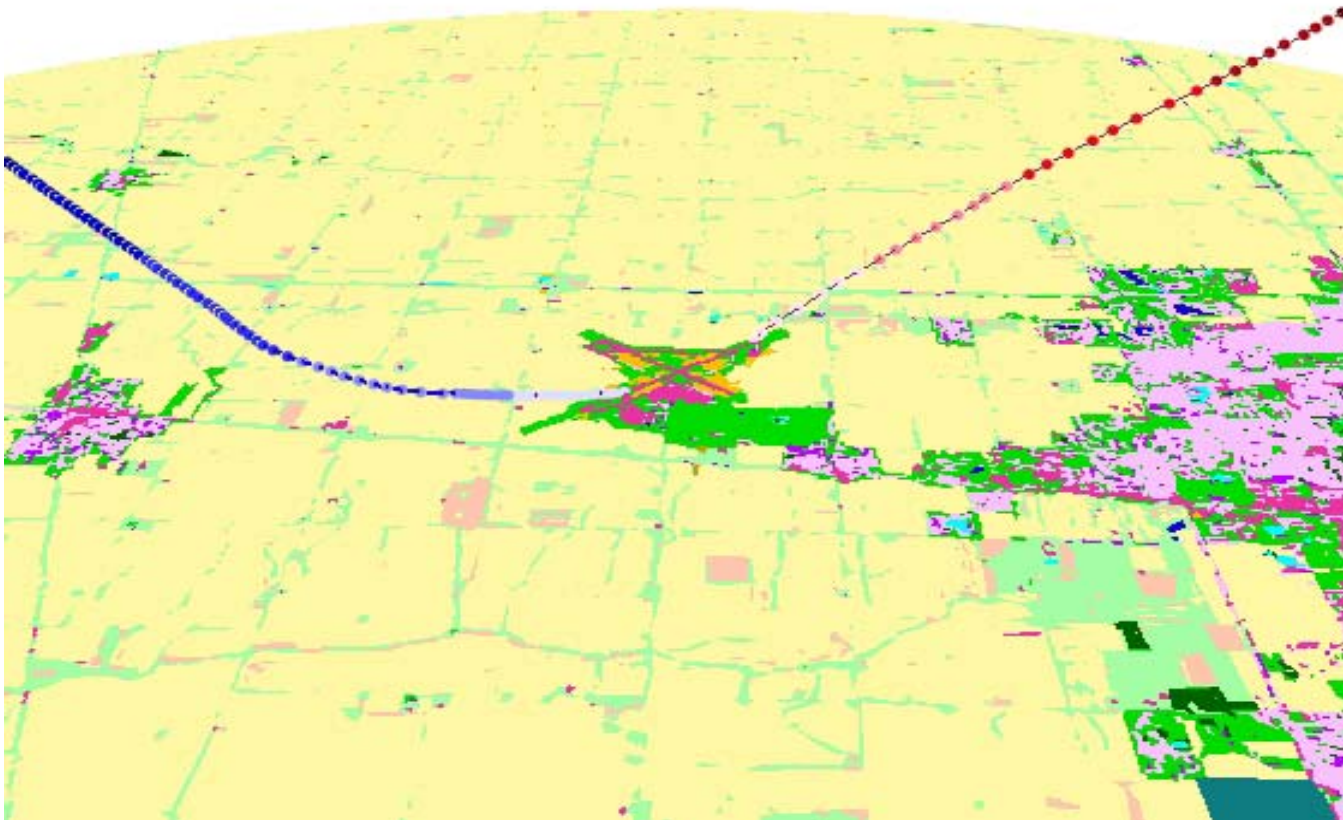
**Dr. Ron Larkin (Radar Applications)**

**Dr. Richard Warner (Deer Management)**

**Dr. Peter Chen (Modeling)**

# 3-D Representation of Bird Strike Risks

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# WHAS Research Activities

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- ➔ **Improve airport wildlife management techniques**
- ➔ **Develop a dynamic GIS-based information system**
- ➔ **Participate in the development of an Real-Time Bird Strike Advisory System**
  - ➔ **This system will use airport radars as the primary detection mode.**

# Airport Wildlife Hazard Mitigation

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- **Embry-Riddle University at Prescott, AZ**
  - **P.I. Dr. Archie Dickey**
- **Establishment and maintenance of the FAA Wildlife Strike Mitigation Website:**  
**<http://wildlife-mitigation.tc.faa.gov>**
- **Development of user-friendly interface to process and analyze wildlife strikes in the U.S.**



# Other COE Activities



- 
- **HBCU Outreach Program.**
  - **COE-sponsored short courses/seminars.**
  - **Active participation in airport and pavement-oriented conferences and symposiums.**
  - **COE members had 5 papers in 2002 FAA Airport Technology Transfer Conference in Atlantic City.**

# FAA CENTERS OF EXCELLENCE



*Resources to advance the technological future  
of the nation's aviation community*



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